

**National Aeronautics and  
Space Administration**

**February 28, 2000**

---

**NRA-00-OES-02**

## **RESEARCH ANNOUNCEMENT**

### **UAV-Based Science Demonstration Program**

---

**Letters of Intent due March 20, 2000  
Proposals due April 27, 2000**

**OMB Approval No. 2700-0087**

# **UAV-Based Science Demonstration Program**

**NASA Research Announcement  
Soliciting Research Proposals  
For  
Period Ending  
April 27, 2000**

**NRA 00-OES-02  
Issued February 28, 2000**

**Office of Earth Science  
National Aeronautics and Space Administration  
Washington, DC 20546**

## **OFFICE OF EARTH SCIENCE (OES)**

### **UAV-BASED SCIENCE DEMONSTRATION PROGRAM**

The National Aeronautics and Space Administration (NASA) announces the solicitation of proposals for a new science demonstration program in support of the Earth Science Enterprise (ESE). The Uninhabited Aerial Vehicle (UAV)-Based Science Demonstration Program (UAVSDP) seeks proposals for basic and applied science investigations which show the utility and promise of UAVs for collecting Earth observations in support of ESE scientific and applications objectives.

#### **1. Introduction**

NASA's Office of Earth Science is dedicated to understanding the total Earth system and the effects of natural and human-induced changes on the global environment. Using the unique perspectives available from space, from within the atmosphere, and from the ground, NASA is observing, documenting, and assessing large-scale environmental processes with current emphases on biology and biochemistry of ecosystems and the global carbon cycle, global water and energy cycle, climate variability and prediction, atmospheric chemistry, and solid earth science. In addition, NASA is extending the use of science and technology through the development and demonstration of applications in the areas of disaster management, environmental quality, food and fiber, human health and safety, natural resources, and urban areas and their infrastructure. ESE space-based observations, complemented by suborbital and ground-based observations, are enabling us to better understand Earth system processes, to determine the role of natural vs human-related activities on these processes, and to understand the consequences of changes resulting from these processes.

The technology which enables Earth science is continually changing. In order to meet the challenges of the future the ESE must use the latest and best technology to enable and obtain new and improved measurements. UAV technology has progressed to the point of readiness for initial science and applications missions that will demonstrate how in the future such platforms will become a robust component of the suborbital program in Earth Science. Unique features of these platforms include long duration at altitude, higher subsonic altitude flight, and the ability to perform missions that would not be suitable or are hazardous to piloted aircraft. Because UAV technology is relatively new to ESE, it is appropriate to introduce it as part of a program to demonstrate that high quality science or applications research missions can be conducted from a UAV platform. The UAV-Based Science Demonstration Program has been created to fulfill that need. It will be a multi-year program, which will employ periodic solicitations, of which this is the first.

#### **2. NASA Research Announcement**

The goals of this NASA Research Announcement (NRA) are to:

- conduct high quality basic and applied research which takes advantage of unique capabilities of UAV platforms,
- demonstrate the utility and reliability of UAVs for Earth science and applications observations, and/or
- build confidence in UAV platforms through scientifically useful UAV-based demonstrations.

This UAVSDP NRA solicits proposals for end-to-end scientific or application investigations, based on an airborne campaign using a UAV platform. The Principal Investigator (PI) will manage the proposed research and have overall responsibility for all aspects of the mission, including the UAV service. Activities within the scope of the NRA may include payload development, integration of sensors with aircraft, aircraft flight time for instrument testing and science data collection, deployment and operation support, and scientific data analysis and reporting. Proposers must describe the scientific rationale for the planned observations and how they support the science and/or applications goals of the Office of Earth Science (see next section for further information on suggested research topics). Prior to proposal submission the PI must have a commitment with a UAV provider for the required flight operations and related support. Proposers shall describe their approach to sensor-vehicle integration and the planned series of science observations and subsequent data analysis.

Activities not considered within the scope of the NRA are UAV platform development and significant new instrument development. These separate activities are sponsored by NASA through technology programs such as the Environmental Research and Sensor Technology and Instrument Incubator Programs. Therefore, proposers must describe

- a UAV service with demonstrated capabilities, i.e. the platform must have sufficient flight heritage such that it can be reasonably assumed to be capable of achieving the flight parameters needed for the proposed science results;
- a payload development that is based on an instrument/payload concept which is sufficiently mature that it can be built (if it does not already exist) and flown during the planned period of performance for this NRA.

### **3. Proposal Research Topics**

The program of the Earth Science Enterprise will be guided by the following scientific themes:

- Biology and Biogeochemistry of Ecosystems and the Global Carbon Cycle
- The Global Water and Energy Cycle
- Climate Variability and Prediction
- Atmospheric Chemistry
- Solid Earth Science

In addition, the Enterprises fosters applications research and commercial developments aimed at more pragmatic issues including:

- Food and Fiber
- Natural Resources
- Disaster Management
- Environmental Quality
- Urban and Infrastructure
- Human Health and Safety

Innovative proposals are encouraged in any of the above areas, although not all areas will necessarily be funded. Proposals should indicate the research or applications area addressed by the proposed mission, the specific measurements that would be made, the airborne mission logistical and platform requirements, and the plan for post mission data analysis. This solicitation encourages all uses of UAVs which meet ESE science and application goals. (Additional information concerning these goals is provided in Appendix B, and through appropriate links found on the Earth Science Enterprise homepage at Internet address <http://www.earth.nasa.gov>.)

Evaluation criteria are listed in Appendix A.

#### **4. Education and Outreach**

Due to the innovative nature of this program in using UAV technology for Earth Science and Applications, the UAVSDP is particularly suited to education and outreach objectives, as described in appropriate links on the homepage referenced above. The proposer should include a component that addresses education outreach to teachers and students, or general outreach using the public media.

#### **5. UAV Definition, Available Aircraft, and Flight Considerations**

For the purposes of this NRA, a UAV is an uninhabited platform flown under either remote or autonomous control to a desired location, landed at a selected site and fully recovered for future flight.

There are a number of UAVs that are available for scientific missions and the proposer is encouraged to explore all options for the platform best matching mission requirements. The UAV industry has made great progress in the development of vehicle capabilities. However, operation of this class of aircraft and the vehicle reliability are in the formative stages and the ability to fly globally or over a specific area may be limited. The flight operations of the UAVs are limited due to both the maturity of the vehicles and the lack of regulatory measures (domestic and internationally) for flight certification and operations. Flight operations must be conducted according to the local aviation rules, standards, regulations and/or guidelines. For UAVs, flight operations are usually

reviewed on a case-by-case basis by the governing authority. In addition, flight operations must comply with the NASA Interim Policy on the Use of Non-NASA aircraft, <http://nodis.hq.nasa.gov/Library/processes.html>. These items should be considered when developing the proposed flight operations. Facilitators have been identified to help potential investigators identify those UAV capabilities most suitable for a mission's science requirements, as well as UAV-unique operational issues and constraints that may affect mission planning. The PI and his team have overall responsibility for all aspects of the mission including procurement of the UAV services, flight planning, airworthiness and flight safety aspects of the mission. An overview of current UAV capabilities and contact information for the facilitators are given in Appendix C.

## **6. Participation**

This announcement is open to all categories of domestic and foreign organizations, including educational institutions, industry, non-profit institutions, NASA research centers, and other government agencies and laboratories (including Federally Funded Research and Development Centers).

International cooperative proposals, with co-investigators from U.S. institutions participating in foreign-led proposals or with co-investigators from non-U.S. institutions on the teams of proposals from U.S. institutions, should be on a "no-exchange-of-funds" basis for their non-U.S. elements and should identify any requirements for NASA financial support for U.S. participants. Proposals from non-U.S. institutions are encouraged, but only on a "no-exchange-of-funds" basis. Specific instructions for proposals from non-U.S. institutions are included in Appendix D.

## **7. Period of Performance**

The period of performance will be 3 years, with annual renewals based on progress assessed via an annual report or review; it is expected that all proposals will show a flight readiness date at most within 24 months of award, to allow data analysis and results at least within the third year. Proposals which can meet earlier flight dates will be given more favorable consideration.

## **8. Funding**

The U.S. Government obligation to make awards is contingent upon the availability of appropriated funds from which payment for award purposes can be made and the receipt of proposals which are determined to be acceptable by the Government for award under this announcement. Funding of the successful proposals will be on the basis of a contract, grant or cooperative agreement, as appropriate. It is planned that at least two proposals will be selected, but no commitment is made to fund missions from all of the science or applications themes identified earlier.

The current budget profile for this program is shown below. This is the total budget planned to cover all awards made under this solicitation.

Table I. Planned Program Budget Profile

FY 2000	FY 2001	FY 2002
\$3M	\$4M	\$5M

## **9. Proposal Procedures**

### *9.1 NRA Web Site*

This announcement and appendices are available on the Earth Science Enterprise home page on the World Wide Web. The URL address is:

<http://www.earth.nasa.gov/> (look under “ ESE Research Announcements”)

There is also a web site to support this NRA:

[http://geo.arc.nasa.gov/uav-nra/uav\\_nra.html](http://geo.arc.nasa.gov/uav-nra/uav_nra.html)

This web site will include frequently asked questions, and other data or links that may be of use to prospective proposers and their partners. In particular, the web site will host a function for investigators to post contact information if they are willing to be contacted by UAV service providers.

### *9.2 Letter of Intent*

All prospective proposers are strongly encouraged to submit a letter of intent in response to this announcement. This will allow us to alert a peer review staff to adequately cover the proposal review process. The template for this letter of intent is available electronically via the Internet at URL: <http://www.earth.nasa.gov/LOI>. We urge you to use these electronic letter of intent forms unless you do not have access to the Internet. In that case, we will accept a FAX copy sent to 202-554-3024 with the following information:

- PI and CoI names and addresses, (including Zip + 4);
- Title of proposal;
- Telephone number;
- Fax number;
- Email address; and
- A brief summary of what you plan to propose (Please limit this to no more than 3000 characters).

### *9.3 Proposal Submission*

Proposals should be prepared and submitted in accordance with specific information provided in Appendices A-F of this Announcement. Appendix A provides additional instructions for proposers to this announcement. Appendix B is a description of Earth Science Enterprise Earth Science Research and Applications Themes. Appendix C provides additional information on UAV programs and potential providers. Appendix D contains the general instructions needed for preparation of solicited proposals in response to NASA Research Announcements, including guidance for international participation. Appendix E provides the list of required declarations and the proposal cover sheet. Appendix F contains a list of acronyms used. All proposals submitted to NASA in response to this announcement must have a completed cover-sheet-form and information on current and pending research support from all other sources (see Appendix E) attached. All proposals from investigators from the U.S. and other countries will be reviewed and evaluated by NASA.

*Submit proposals to:* OES UAVSDP NRA  
Code Y  
400 Virginia Avenue, SW  
Suite 700  
Washington, DC 20024  
(For overnight delivery purposes only,  
the recipient telephone number is 202-554-2775)

*Selecting Official:* Associate Administrator for Earth Science  
NASA Headquarters

*Point of Contact for Program Information:*  
Cheryl Yuhas, Suborbital Sciences Program Manager  
OES Code YS  
NASA Headquarters  
Washington, DC 20546-0001  
Tel: (202) 358-0758  
Fax: (202) 358-3098  
[cyuhas@mail.hq.nasa.gov](mailto:cyuhas@mail.hq.nasa.gov)

Proposals submitted to NASA Headquarters may cause a delay in receipt of your proposals, therefore, please adhere to the instructions noted above.

#### 9.4 *Selection Schedule:*



All proposals submitted in response to this announcement are due in accordance with the schedule shown below. Late proposals will not be considered for review and funding, unless it is judged to be in the interest of the U.S. Government.

A complete proposal schedule is given below:

NRA Release ----- February 28, 2000

Letter of Intent to Propose due -----March 20, 2000

Proposals due -----April 27, 2000

Peer Review----- April 28 – May 26, 2000

Announcement of Final Selections----- June, 2000

Award (Target) -----July 2000

Your interest in participating in this opportunity is heartily welcomed.

Ghassem R. Asrar  
Associate Administrator for Earth Science

Enclosures:

Appendix A. Specific Guidelines for Proposers  
Appendix B. Earth Science Enterprise Earth Science Research and Application Themes  
Appendix C. Information on Some Candidate UAV Platforms  
Appendix D. Instructions for Responding to NASA Research Announcements  
Appendix E. Proposal Cover Sheet, Formats, Forms, And Required Declarations  
Appendix F. List of Acronyms Used in this Research Announcement

## **Appendix A**

### **Specific Guidelines for Proposers**

In addition to addressing all of the requirements of section (c) of Appendix D, each proposal should address each of the following items under the project description:

- the specific science or application investigation to be conducted and its relationship to the Earth Science Enterprise science research and applications themes (Appendix B);
- the UAV payload and mission concept;
- sensor development and/or adaptation and integration;
- the nature of the flights to be conducted;
- the approach to science data analysis;
- the UAV service that will support the flights, describing scope, schedule, evidence of capability, liability and risk assessment, and preliminary airspace management plan (a letter of commitment from the provider of the UAV service should be attached to the proposal). The costs of the flight portion of the proposal should be separately delineated in the cost section.
- an outreach component of approximately 1% of the proposal's value that addresses how to increase public awareness of the project, its purpose and benefit to the public, or how teachers may be trained for student activities associated with the field mission or its science objectives.

### **Evaluation Criteria**

The selection of investigations that best meet the scientific and programmatic objectives stated in the NRA is the fundamental aim of the proposal evaluation process. The evaluation approach is designed to determine the investigations with the best science or applications return per unit cost to NASA, adjusted for the probability that the investigations can be achieved within the established limits of cost and schedule. The information requested in Appendix D will enable the evaluation panel to determine how well each team understands the complexity of the proposed investigation, its technical risks, and challenges. This information will also enable the evaluation panel to rank the proposed investigations, and will provide the necessary discriminators to permit selection of those proposals which best meet all guidelines and constraints, and which address all elements viewed necessary to mission success. This section supersedes section (i), Evaluation Factors, of Appendix D.

The criteria are listed below in descending order of importance, with the difference in the weights of the criteria being essentially equal.

1. The quality and relevance of the investigation to ESE objectives, its use of innovative methods, approaches or concepts, and the extent to which it must rely on unique

advantages of the UAV environment as a platform of choice for the proposed science or applications data acquisition.

2. The soundness and cohesiveness of the proposed investigation in terms of technical and management approach, commitment of partnered organizations, qualifications of key personnel, critical capabilities, experience and facilities; the capability of the UAV platform selected to safely and reliably complete the science mission; and the likelihood of investigation success (risk management) considering the programmatic constraints of cost and schedule, and past performance of the participating organizations, as applicable.

3. Realism and reasonableness of proposed cost relative to available funds. Cost sharing from other organizations or partners is encouraged and will be viewed favorably.

4. The degree to which the investigation offers unique aspects of value to NASA beyond science value, including, but not limited to commercialization, outreach, and relevance to other applications, as well as inclusion of scientists and engineers from a broad range of institutions, including those institutions with a large enrollment of minority students (Historically Black Colleges and Universities, Hispanic Serving Institutions, and Tribal Colleges).

### **Data Policy**

Within a reasonable period to be negotiated following the end of each flight, the principal investigator will be required to produce a preliminary data set for exchange (ideally via Internet) with other members of the science team. Sharing of data among team members within 24 hours is encouraged. A final submission of data with supporting documentation is required to a central data facility approximately six months following the completion of the mission. Exact format for data distribution will be negotiated, but may include CD-ROM preparation.

### **Other Guidelines**

The length section of Appendix D is revised as follows:

The maximum length of each proposal is limited to 25 non-reduced, single-space typewritten pages for the total of the project description, management approach, personnel, and facilities and equipment sections (that is, the whole proposal, excluding the forms in Appendix E and cost information, is limited to 25 pages). Each side of a sheet of paper containing text or figures is considered a page. Use type font 10 point or larger, minimum one inch margins, and standard 8.5 x 11 inch paper. Proposals should be submitted without any non-recyclable material (e.g. plastic binding, plastic covers).

Respondents having support from other NASA and/or non-NASA sources, that are essential to the conduct of their experiment, should include a list of such support and

clear, concise statements of how their work proposed under this NRA complements and/or extends their currently-funded work, and demonstrate that such funds are available during execution of their experiments.

Vitae should be included for each principal investigator and co-investigator associated with the proposal. In order to keep the size of proposals to a reasonable level, no more than two pages (including a summary of education, relevant experience, honors, awards, community service activities, and a listing of the most relevant publications) should be included for each principal or co-investigator. These pages will not be included in the page count.

The proposer should also submit a one page "fact sheet" and one color viewgraph which succinctly summarize the proposed mission. These two sheets are not included in the page count.

The proposer shall submit 10 paper copies and one or more 3 1/2" magnetic disks (Macintosh or IBM PC compatible format) with the proposal in Microsoft Word or compatible word processor format. If color is used, all copies must use it. An acceptable alternative media is IBM PC formatted CD-ROM. Cost data other than explanations should be in Microsoft Excel or compatible spreadsheets.

## **Appendix B**

### **EARTH SCIENCE RESEARCH THEMES**

#### **1. BIOLOGY AND BIOGEOCHEMISTRY OF ECOSYSTEMS AND THE GLOBAL CARBON CYCLE**

Earth's ecosystems are being subjected to human intervention and environmental changes on an unprecedented scale, in both rate and geographical extent. The ability of human societies to ameliorate, adapt to, or benefit from these rapid changes requires fundamental knowledge of the responses of terrestrial and marine ecosystems to global change. Also required is an understanding of the implications of changes in natural and managed ecosystems for increased food production, sustainable resource management, and the maintenance of a healthy, productive environment. As human societies seek to develop policies that respond to the impacts of global change, there will be a continuing requirement for objective, scientific information to understand the current impacts and predict the future effects of such policies. Presently there is an urgent need for information on the sources and sinks of carbon dioxide in the environment and on the capacity of terrestrial and marine ecosystems to store carbon dioxide released to the atmosphere as a result of human activities.

NASA research on the biology and biogeochemistry of ecosystems and the global carbon cycle seeks to use remote sensing and related technologies to understand and predict how terrestrial and marine ecosystems are changing. This research theme addresses ecosystems as they are affected by human activity, as they change due to their own intrinsic biological dynamics, and as they respond to climatic variations and, in turn, affect climate. Emphasis is on understanding the processes and patterns of the Earth system that affect its capacity for biological productivity and the role of the Earth's biosphere in Earth system function. Documenting changes in land cover and land use is a priority. Understanding the distribution and cycling of carbon among land, ocean, and atmospheric reservoirs constitutes a major scientific focus for research as well as a new priority for interagency cooperation and international assessment. Questions that will drive this research include:

- **How do ecosystems respond to and affect global environmental change?**
- **How are land cover and land use changing? What are the causes and consequences?**
- **What is the role of ecosystems in the global carbon cycle and how might it change in the future?**

## 2. GLOBAL WATER AND ENERGY CYCLE

The recycling of water in the Earth atmosphere is the process that effects the renewal of fresh water on the planet, a unique feature in the solar system. The National Research Council report on *Research Pathways for the Next Decade – Overview* (NRC, 1998a) highlights the study of the global water cycle as one of the principal cross-cutting research themes that emerged from their review of the US Global Change Research Program:

"Water is at the heart of both the causes and the effects of climate change. It is essential to establish rates of and possible changes in precipitation, evapotranspiration, and cloud water content. Better measurements are needed of water runoff, river flow and the quantities of water involved in various human uses." Indeed, any significant change in the global hydrologic regime could entail serious consequences in regions where water resources are already strained by the ever-increasing needs of human population, agriculture and industry.

In addition, the release of latent heat associated with precipitation is the principal source of energy that drives the atmospheric circulation and weather systems. Quantifying the global water cycle cannot be dissociated from the study of energy sources, sinks and transformations in atmospheric dynamics. Both water cycle and energy exchange processes are intimately linked to weather systems that evolve over periods of hours or days, and horizontal scales of tens to hundreds of kilometers. Scientific progress in this domain is dependent upon the capability both to observe these phenomena with appropriately high spatial and temporal resolution, and to handle the resulting large data flow.

A decade of planning and technology development has enabled NASA to embrace the spatial diversity and temporal variability of atmospheric phenomena, and address the basic connection between weather and climate (Chapter 2 of the EOS Science Plan: *Radiation, Cloud, Water Vapor, Precipitation and Atmospheric Circulation*; NASA, 1999). New space-based observing techniques, such as demonstrated by the Tropical Rainfall Measuring Mission and forthcoming EOS missions, will provide much enhanced knowledge of land vegetation and its role in evapotranspiration, cloud distributions and their role in the planetary radiation balance, precipitation, and the role of latent heat in the development of weather systems. Field campaigns, conducted in environmentally sensitive regions such as the Amazonian rain forest and major watersheds like the Mississippi river basin, collect coordinated *in situ* and satellite measurements, and assemble reference data bases that will serve to constrain and test model computations for many years to come. Coupled atmospheric-hydrologic models are reaching the stage where they will be a powerful tool for environmental assessments and experimental hydrologic predictions.

This research theme emphasizes the concept of planetary-scale hydrology and climate linkages, introduced in National Research Council strategic planning studies such as *Hydrologic Sciences- Taking Stock and Looking Ahead* (NRC, 1998b). It builds upon the framework of the Global Energy and Water Cycle Experiment (GEWEX) in the World Climate Research Programme, and the Biospheric Aspects of the Hydrological Cycle (BAHC) core-project in the International Geosphere-Biosphere Program. The goal of NASA is to lead a cooperative research effort, together with partner agencies in the US Global Change Research Program, and make key scientific contributions based on its unique capabilities for global observation from space, data analysis and Earth system modeling. The overarching objective is to improve the understanding of the global water cycle to the point where useful predictions of regional hydrologic regimes can be made. This detailed predictive capability is essential to deliver meaningful information for practical application to water resource management, and for validating scientific advances through the test of real-life predictions. Another, more fundamental, scientific objective is to improve the understanding of atmospheric energy exchange processes and their relationship to general circulation dynamics, so as to enable quantitative predictions of the response of the Earth climate to external forcing. Questions to be addressed by this research include:

- **Is the cycling of water through the atmosphere accelerating?**
- **To what extent are variations in local weather, precipitation and water resources related to global climate change?**
- **How can the integrated effect of fast atmospheric, land and ocean surface processes be accurately included in large-scale climate models?**

### **3. CLIMATE VARIABILITY AND PREDICTION**

Climate variability encompasses long-term trends and regional-to-global scale transient variations that occur over periods of a season or longer. Variations include natural (intrinsic) variability that results from the internal dynamics of the climate system, as well as forced changes resulting from the response of the climate system to changes in relevant external factors, such as radiation from the sun or greenhouse gases introduced by human activities. For the purpose of the NASA Earth science program, the climate system is defined as the global atmosphere, oceans, ice, and land surface, and physical interactions that occur between the components of this system. NASA recognizes that the response of the Earth climate and environment to various disturbances may involve a broader range of interactions, including biogeochemical processes as well as changes in terrestrial and marine ecosystems.

The NASA research program on Climate Variability and Prediction is consistent with the concepts and recommendations put forward in National Research Council reports on *Decade-to-Century-Scale Climate Variability and Change: A Science Strategy* (NRC,

1998a) and *Global Environmental Change: Research Pathways for the Next Decade – Overview* (NRC, 1998b). The research program focuses on the modes of variability that involve, in a fundamental way, the dynamics of the slower components of the physical climate system (the ocean circulation, snow and ice) that respond to external disturbances with greater inertia and, therefore longer "memories," than the atmosphere itself.

Research activities are focused on understanding the ocean circulation, air-sea exchanges, sea-ice processes, and the mass balance of polar ice sheet, as well as the long-term measurement of radiative forcing factors that can be monitored from space, e.g. total and spectrally resolved solar irradiance, aerosol distribution. Improved understanding of atmospheric and hydrologic processes is a central objective of NASA's Earth system science research strategy.

This and the other components of the NASA Earth science program address the scientific priorities of the US Global Change Research Program at the national level and the World Climate Research Programme (WCRP) in the international arena. NASA will continue to participate in the worldwide interdisciplinary research effort on climate change, in cooperation with other US and foreign agencies or institutions, and aims to make key contributions based on its unique capabilities for high-quality measurements from space, global data analysis and Earth system modeling. The overarching objective is to improve the understanding of climate mechanisms to the point where useful prediction of regional climate change can be made. Scientific questions to be addressed by this research include:

- **Can current global climate variations be understood and predicted?**
- **Can the observed climate trends be attributed to specific factors?**
- **Can change in polar ice sheets seriously affect global sea level?**

#### **4. ATMOSPHERIC CHEMISTRY**

The Earth atmosphere is the fluid that connects most effectively the other components of the Earth System –the oceans, the marine and terrestrial ecosystems, the geosphere and the cryosphere – and provides the medium in which these components interact. It is a chemically complex and dynamic mixture, the composition and structure of which represent a balance among competing processes. Changes to that balance, caused by natural phenomena or human action, can strongly influence life on Earth, either directly through changes in chemicals present in the atmosphere, or indirectly through coupling with other components of the Earth System. Atmospheric change is the result of strongly interactive chemical and physical processes. Atmospheric temperature, for example, depends on chemical composition, while the nature and rates of chemical processes depend on temperature. In other words, chemistry plays a role in determining climate, while the physics and dynamics of the atmosphere influence chemical processes and composition. The overarching goals of the NASA Atmospheric Chemistry research



program are to measure and understand how atmospheric composition is changing in response to natural and anthropogenic forcings, and to enable accurate prediction of future changes in ozone and surface ultraviolet radiation, climate, and global pollution.

Questions to be addressed by this research include:

- **How will stratospheric ozone respond to the reductions in atmospheric abundance of ozone-destroying industrial chemicals?**
- **How does the chemistry of atmospheric trace constituents respond to and affect climate?**
- **What are the effects of regional pollution on the global atmosphere, and the effects of global chemical and climate changes on regional air quality?**

## **5. SOLID EARTH SCIENCE**

From a geophysical perspective, Earth is unique among terrestrial planets in that it is a dynamic system that contains abundant water and also supports life. Earth has profoundly evolved over the 4.5 billion years of its existence, constantly reforming its surface and overturning its interior with a vigor that is often disruptive to the life it supports. The basic structure of the Earth's interior was understood in some detail by the end of the 1930's; it was known that the planet has a metallic core, surrounded by a mantle of dense minerals, then by a less dense crust, and finally by thin oceanic and atmospheric layers. Yet the fact that every one of these elements is in motion, manifesting a vast range of velocities over a diversity of scales, has only been known since the 1960's. A fundamental question is whether Earth's distinctive dynamism is a cause of the other unique features, the presence of liquid water and life, or a consequence of the former. To address this fundamental question, we must understand the mechanics of the Earth's interior and surface, and governing mechanical, physical and chemical processes.

Observations made solely from the Earth's surface had long hobbled scientific imagination. Gazing on quiet landscapes, the human perception of the Earth's dynamism was restricted to infrequent catastrophes - violent earthquakes, volcanic eruptions - or low key but persistent erosion processes. Today, the global perspective from space offers a new outlook, a planetary reference frame from which to precisely determine the motion of the mantle, overturning as a viscous fluid; to observe the planet's magnetic field fluctuating with the turbulence of its liquid metal core; to measure changes in the length of day forced by ocean currents and global winds; to watch how continents strain in anticipation of an earthquake or volcanic eruption.

NASA's Solid Earth research program examines the dynamics of the solid Earth at virtually all spatial and temporal scales, and aims to establish the scientific basis for reconstructing Earth's past history and predicting its future evolution. The overarching goal is to observe and understand the fundamental properties and processes of Earth's

interior and crust that make it dynamic. The same effort also provides essential information to guide decision-making on issues of great human import by illuminating society's vulnerability to natural hazards.

NASA's objective in this domain is to contribute to scientific understanding and provide technical leadership through pioneering space geodesy and remote sensing programs. The program requires highly accurate geodetic measurements to monitor the terrestrial reference frame, precise measurements of the static and time-dependent components of the Earth's gravity and magnetic fields, and observations of the Earth surface geologic nature, topography, elevation, and deformation with time. The program will improve the understanding of dynamical processes in the solid Earth and their interactions with other elements of the environment, including impacts on human societies and the assessment of vulnerability to natural hazards. In fact, the solid Earth science element is fully integrated with NASA's Natural Hazards program, as part of the overall "Solid Earth and Natural Hazard Program" of the Earth Science Enterprise. The scientific research effort is comprised of two major components: 1) understanding the fundamental geophysics and geodynamics of the Earth's interior; and, 2) understanding global geological processes that shape the topographic surface of the Earth. Scientific questions to be addressed include:

- **What are the motions of Earth's interior and what information can be inferred about Earth's internal processes?**
- **How is the Earth's surface being transformed and how can such information be used to predict future changes?**

## **EARTH SCIENCE APPLICATIONS THEMES**

Applications themes are similar in concept to the high-level science themes and questions that drive the scientific research in the Earth Science Enterprise as described above. The major difference is that the applications themes are defined by public and private sector markets and necessities, and not scientific curiosity. The applications research may lead to operational or commercial activities in other agencies and/or industry and therefore have a substantial benefit to society.

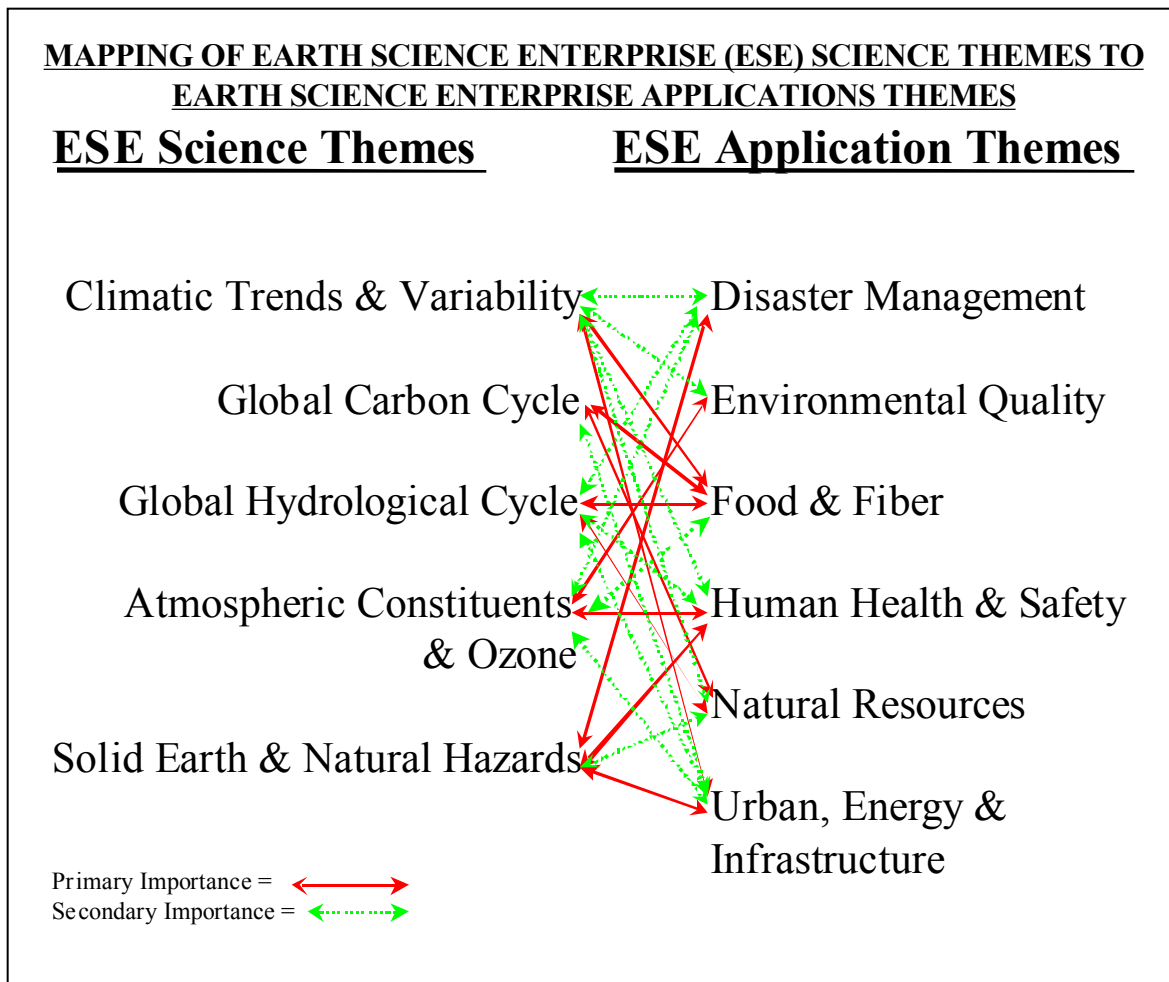
A list of the current themes that will define the near-term programmatics include Disaster Management, Environmental Quality, Food and Fiber, Human Health and Safety, Natural Resources, and Urban and Infrastructure. These themes have been selected in cooperation with the user sectors and beneficiaries of the Earth Science Enterprise.

### **Earth Science Enterprise Applications, Commercialization, and Education Themes**

- **Food and Fiber**
  - e.g., Precision Agriculture, Pest control, Forestry, Rangelands
- **Natural Resources**
  - e.g., Land Use/Land Cover, Wetlands, Mineral/Energy Exploration and Extraction, Recreation, Water Resources, Wildlife Management, Biodiversity and Habitat Analysis, Coastal and Ocean Systems (Fisheries, Human Impact on Marine Systems)
- **Disaster Management**
  - e.g., Earthquakes, Volcanic Eruptions and Ash Clouds, Landslides, Coastal Hazards, Wildfires, Flooding, Severe Storms
- **Environmental Quality**
  - e.g., Air Quality, Tropospheric Ozone, Water Quality, Soils, Abandoned Mines, Brownfields, Urban Heat Islands
- **Urban and Infrastructure**
  - e.g., Growth Management, Urban and Regional Planning, Infrastructure Planning (Transportation, Communication and Utilities)
- **Human Health and Safety**
  - e.g., Public health (Water, Air, Carcinogens (aerosols), Ozone), Vector-borne and Infectious Diseases

Earth Science Enterprise Applications themes have been mapped back to Earth Science Enterprise Science themes (see figure below). This mapping is not a simple one-to-one

translation but a complex set of interconnections. The mapping further illustrates that each application issue is interdisciplinary in nature and requires input and knowledge from multiple scientific issues to be successfully defined and implemented. Nonetheless, although the level of maturity of each connection may be variable, the development of applications themes will be founded on the strongest Earth Science Enterprise science possible.



Applied research and applications development is issue-driven and represents a continuum, or a “bridge,” between Earth Science Enterprise science and the factors that drive the market adoption of applications in the user/beneficiary sectors.

## **Appendix C**

### **UAV Platform Information**

UAVs are available with varying capabilities. The most important performance parameters for consideration are altitude, endurance (time in flight), range (distance covered in flight), and payload-carrying capability (weight and volume). Other payload-related considerations are the operational flexibility of the UAV to land and take-off in areas of interest and on a time-schedule to exploit the observational targets, as well as the environment experienced by the payload (controlled or subject to ambient variations), location on the aircraft (important for air sampling, viewing, etc.), electrical power, and ease of installation. Operational considerations include communications options for both platform command and control (over-the-horizon capability is required for controlling the vehicle should the observations require flight beyond line-of-sight) and payload control and data downlink. These features need to be considered when selecting a platform suitable for science and applications.

Exhibit C1 is a representative summary of known UAV performance indicating a range of Altitude, Payload and Endurance capabilities. These UAVs represent different developers: many were developed for military applications, some were developed for NASA, and several were developed through private funding. The chart does not represent a complete list of all available UAVs but is provided as a resource to the potential proposers to illustrate the range of UAV capabilities.

It is the intent of this NRA that proposers seek out those UAV platforms which meet their science or applications objectives and with which unique missions can be performed. An excellent resource for information about UAVs is the web page of the industry trade association, the International Association for Unmanned Systems (IAUS, formerly the Association of Unmanned Vehicle Systems International, AUVSI) at <http://users.erols.com/auvsicc/>. In addition, facilitators can answer questions about available platforms and ranges, and provide guidance as described below.

### **Facilitators: Roles and Responsibilities**

Recognizing that as an emerging technology, information on UAVs in terms of technical capabilities, operating and regulatory constraints is limited, NASA is providing a library resource for potential proposers. Information on UAV platforms, services, ranges, and regulations has been collected with the assistance of industry; that information will be available through 3 government points of contact designated as “Facilitators.”

Facilitators will assist potential proposers in identifying UAV-related issues and concerns, such as interpretation of the UAV platform capabilities tables, platform

operational and regulatory constraints, air worthiness and flight safety aspects, or liability issues. Facilitators will also provide points of contact for the various UAV vendors or ranges, as requested. Proposers who wish to be contacted directly by UAV vendors will be given the opportunity to make their names and contact information available to all interested UAV vendors on an impartial basis.

NASA has made every effort to be thorough and accurate in preparing the UAV library reference for the Facilitators' use; however, the PI is responsible for ensuring the accuracy of the information, etc. through direct contact with the providers. Facilitators will provide contact information on request, as noted above. In order to assure fair competition among proposers, the library reference used by the Facilitators will not be changed during the solicitation period.

Facilitators will not become part of the proposer's team, nor will they assist in the development of an investigator's proposal, or in any negotiations between UAV vendor and investigator. Facilitators are prohibited from exchanging information provided by proposers and will keep all such information confidential. Facilitators cannot provide advice to proposers on the science content of the investigator's proposal. The Principal Investigator has sole responsibility the proposal, and the successful execution upon award.

Glenn Hamilton  
NASA Dryden Flight Research Center  
661/258-3748  
glenn.hamilton@dfrc.nasa.gov

Dr. Haflidi Jonsson  
Center for Interdisciplinary Remotely-Piloted Aircraft Studies (CIRPAS)  
831/384-2776  
hjonsson@nps.navy.mil

David Pierce  
Goddard Space Flight Center/Wallops Flight Facility  
757/824-1749  
dlpierce@pop800.gsfc.nasa.gov

Other references:

1997-98 International Guide to Unmanned Vehicles, co-sponsored by Aviation Week & Space Technology and Association for Unmanned Vehicle Systems International, McGraw-Hill Companies, May 1997, ISBN 007-607102-2.

Limited copies of this volume are available from the facilitators. Additional copies may be purchased from IAUS, 3401 Columbia Pike, Suite 400, Arlington, VA 22204.

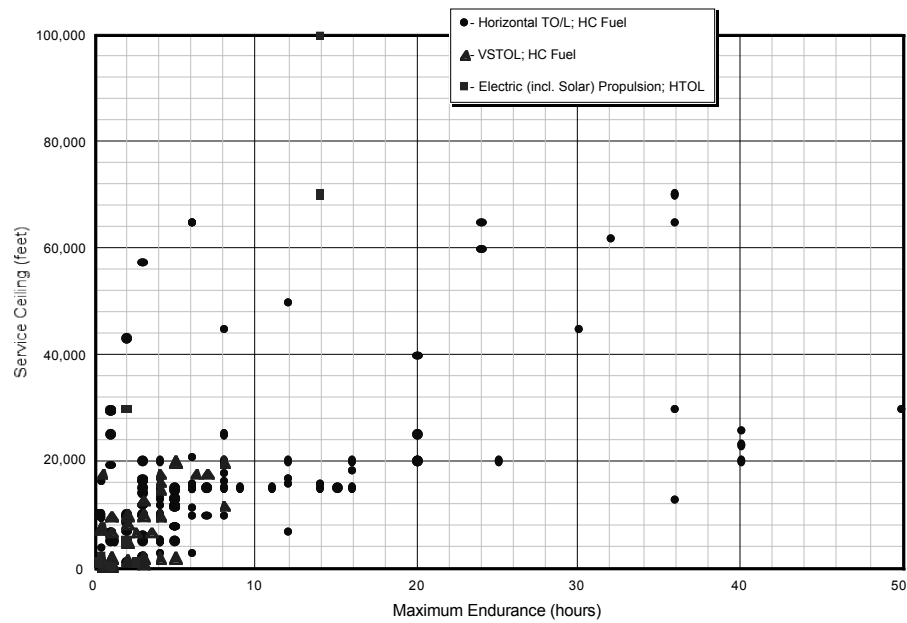
## Exhibit C1. Uninhabited Aerial Vehicle Categories and Capabilities

### VEHICLE CATEGORIES

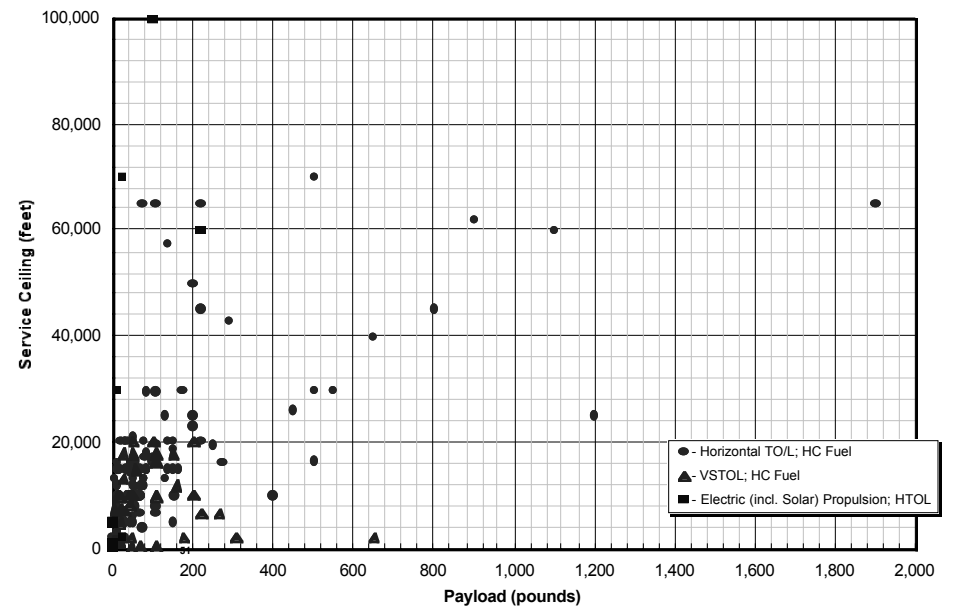
CAPABILITIES	LOCAL	REGIONAL	ENDURANCE
Altitude Range (km)	0-5	0-5	0-24
(ft)	0-15,000	0-15,000	0-80,000
Endurance (hrs)	3	3-7	>20
Operations Radius (km)	60	110	1000-6400 *
(mi)	40	70	600-4000 *

\*Requires “Over-the-Horizon” communications

### UAV Capability – Endurance



### UAV Capability – Payload Mass





VSTOL: Vertical/Short Take-Off and Landing

HTOL: Horizontal Take-Off and Landing

HC Fuel: Hydrocarbon Fuel

## **Appendix D**

### **INSTRUCTIONS FOR RESPONDING TO NASA RESEARCH ANNOUNCEMENTS**

(JANUARY 2000)

#### **(a) General.**

(1) Proposals received in response to a NASA Research Announcement (NRA) will be used only for evaluation purposes. NASA does not allow a proposal, the contents of which are not available without restriction from another source, or any unique ideas submitted in response to an NRA to be used as the basis of a solicitation or in negotiation with other organizations, nor is a pre-award synopsis published for individual proposals.

(2) A solicited proposal that results in a NASA award becomes part of the record of that transaction and may be available to the public on specific request; however, information or material that NASA and the awardee mutually agree to be of a privileged nature will be held in confidence to the extent permitted by law, including the Freedom of Information Act.

(3) NRAs contain programmatic information and certain requirements which apply only to proposals prepared in response to that particular announcement. These instructions contain the general proposal preparation information which applies to responses to all NRAs.

(4) A contract, grant, cooperative agreement, or other agreement may be used to accomplish an effort funded in response to an NRA. NASA will determine the appropriate instrument. Contracts resulting from NRAs are subject to the Federal Acquisition Regulation and the NASA FAR Supplement. Any resultant grants or cooperative agreements will be awarded and administered in accordance with the NASA Grant and Cooperative Agreement Handbook (NPG 5800.1).

(5) NASA does not have mandatory forms or formats for responses to NRAs; however, it is requested that proposals conform to the guidelines in these instructions. NASA may accept proposals without discussion; hence, proposals should initially be as complete as possible and be submitted on the proposers' most favorable terms.

(6) To be considered for award, a submission must, at a minimum, present a specific project within the areas delineated by the NRA; contain sufficient technical and cost information to permit a meaningful evaluation; be signed by an official authorized to legally bind the submitting organization; not merely offer to perform standard services or

to just provide computer facilities or services; and not significantly duplicate a more specific current or pending NASA solicitation.

**(b) NRA-Specific Items.** Several proposal submission items appear in the NRA itself: the unique NRA identifier; when to submit proposals; where to send proposals; number of copies required; and sources for more information. Items included in these instructions may be supplemented by the NRA.

**(c) The following information is needed to permit consideration in an objective manner.** NRAs will generally specify topics for which additional information or greater detail is desirable. Each proposal copy shall contain all submitted material, including a copy of the transmittal letter if it contains substantive information.

(1) Transmittal Letter or Prefatory Material.

(i) The legal name and address of the organization and specific division or campus identification if part of a larger organization;

(ii) A brief, scientifically valid project title intelligible to a scientifically literate reader and suitable for use in the public press;

(iii) Type of organization: e.g., profit, nonprofit, educational, small business, minority, women-owned, etc.;

(iv) Name and telephone number of the principal investigator and business personnel who may be contacted during evaluation or negotiation;

(v) Identification of other organizations that are currently evaluating a proposal for the same efforts;

(vi) Identification of the NRA, by number and title, to which the proposal is responding;

(vii) Dollar amount requested, desired starting date, and duration of project;

(viii) Date of submission; and

(ix) Signature of a responsible official or authorized representative of the organization, or any other person authorized to legally bind the organization (unless the signature appears on the proposal itself).

(2) Restriction on Use and Disclosure of Proposal Information. Information contained in proposals is used for evaluation purposes only. Offerors or quoters should, in order to

maximize protection of trade secrets or other information that is confidential or privileged, place the following notice on the title page of the proposal and specify the information subject to the notice by inserting an appropriate identification in the notice. In any event, information contained in proposals will be protected to the extent permitted by law, but NASA assumes no liability for use and disclosure of information not made subject to the notice.

## Notice

### Restriction on Use and Disclosure of Proposal Information

The information (data) contained in [insert page numbers or other identification] of this proposal constitutes a trade secret and/or information that is commercial or financial and confidential or privileged. It is furnished to the Government in confidence with the understanding that it will not, without permission of the offeror, be used or disclosed other than for evaluation purposes; provided, however, that in the event a contract (or other agreement) is awarded on the basis of this proposal the Government shall have the right to use and disclose this information (data) to the extent provided in the contract (or other agreement). This restriction does not limit the Government's right to use or disclose this information (data) if obtained from another source without restriction.

(3) Abstract. Include a concise (200-300 word if not otherwise specified in the NRA) abstract describing the objective and the method of approach.

(4) Project Description.

(i) The main body of the proposal shall be a detailed statement of the work to be undertaken and should include objectives and expected significance; relation to the present state of knowledge; and relation to previous work done on the project and to related work in progress elsewhere. The statement should outline the plan of work, including the broad design of experiments to be undertaken and a description of experimental methods and procedures. The project description should address the evaluation factors in these instructions and any specific factors in the NRA. Any substantial collaboration with individuals not referred to in the budget or use of consultants should be described. Subcontracting significant portions of a research project is discouraged.

(ii) When it is expected that the effort will require more than one year, the proposal should cover the complete project to the extent that it can be reasonably anticipated. Principal emphasis should be on the first year of work, and the description should distinguish clearly between the first year's work and work planned for subsequent years.

(5) Management Approach. For large or complex efforts involving interactions among numerous individuals or other organizations, plans for distribution of responsibilities and arrangements for ensuring a coordinated effort should be described.

(6) Personnel. The principal investigator is responsible for supervision of the work and participates in the conduct of the research regardless of whether or not compensated under the award. A short biographical sketch of the principal investigator, a list of principal publications and any exceptional qualifications should be included. Omit social security number and other personal items which do not merit consideration in evaluation of the proposal. Give similar biographical information on other senior professional personnel who will be directly associated with the project. Give the names and titles of any other scientists and technical personnel associated substantially with the project in an advisory capacity. Universities should list the approximate number of students or other assistants, together with information as to their level of academic attainment. Any special industry-university cooperative arrangements should be described.

(7) Facilities and Equipment.

(i) Describe available facilities and major items of equipment especially adapted or suited to the proposed project, and any additional major equipment that will be required. Identify any Government-owned facilities, industrial plant equipment, or special tooling that are proposed for use. Include evidence of its availability and the cognizant Government points of contact.

(ii) Before requesting a major item of capital equipment, the proposer should determine if sharing or loan of equipment already within the organization is a feasible alternative. Where such arrangements cannot be made, the proposal should so state. The need for items that typically can be used for research and non-research purposes should be explained.

(8) Proposed Costs (U.S. Proposals Only).

(i) Proposals should contain cost and technical parts in one volume: do not use separate "confidential" salary pages. As applicable, include separate cost estimates for salaries and wages; fringe benefits; equipment; expendable materials and supplies; services; domestic and foreign travel; ADP expenses; publication or page charges; consultants; subcontracts; other miscellaneous identifiable direct costs; and indirect costs. List salaries and wages in appropriate organizational categories (e.g., principal investigator, other scientific and engineering professionals, graduate students, research assistants, and technicians and other non-professional personnel). Estimate all staffing data in terms of staff-months or fractions of full-time.

(ii) Explanatory notes should accompany the cost proposal to provide identification and estimated cost of major capital equipment items to be acquired; purpose and estimated number and lengths of trips planned; basis for indirect cost computation (including date of most recent negotiation and cognizant agency); and clarification of other items in the cost proposal that are not self-evident. List estimated expenses as yearly requirements by major work phases.

(iii) Allowable costs are governed by FAR Part 31 and the NASA FAR Supplement Part 1831 (and OMB Circulars A-21 for educational institutions and A-122 for nonprofit organizations).

(iv) Use of NASA funds--NASA funding may not be used for foreign research efforts at any level, whether as a collaborator or a subcontract. The direct purchase of supplies and/or services, which do not constitute research, from non-U.S. sources by U.S. award recipients is permitted. Additionally, in accordance with the National Space Transportation Policy, use of a non-U.S. manufactured launch vehicle is permitted only on a no-exchange-of-funds basis.

(9) Security. Proposals should not contain security classified material. If the research requires access to or may generate security classified information, the submitter will be required to comply with Government security regulations.

(10) Current Support. For other current projects being conducted by the principal investigator, provide title of project, sponsoring agency, and ending date.

(11) Special Matters.

(i) Include any required statements of environmental impact of the research, human subject or animal care provisions, conflict of interest, or on such other topics as may be required by the nature of the effort and current statutes, executive orders, or other current Government-wide guidelines.

(ii) Proposers should include a brief description of the organization, its facilities, and previous work experience in the field of the proposal. Identify the cognizant Government audit agency, inspection agency, and administrative contracting officer, when applicable.

#### **(d) Renewal Proposals.**

(1) Renewal proposals for existing awards will be considered in the same manner as proposals for new endeavors. A renewal proposal should not repeat all of the information that was in the original proposal. The renewal proposal should refer to its predecessor, update the parts that are no longer current, and indicate what elements of the research are expected to be covered during the period for which support is desired. A description of

any significant findings since the most recent progress report should be included. The renewal proposal should treat, in reasonable detail, the plans for the next period, contain a cost estimate, and otherwise adhere to these instructions.

(2) NASA may renew an effort either through amendment of an existing contract or by a new award.

**(e) Length.** Unless otherwise specified in the NRA, effort should be made to keep proposals as brief as possible, concentrating on substantive material. Few proposals need exceed 15-20 pages. Necessary detailed information, such as reprints, should be included as attachments. A complete set of attachments is necessary for each copy of the proposal. As proposals are not returned, avoid use of "one-of-a-kind" attachments.

**(f) Joint Proposals.**

(1) Where multiple organizations are involved, the proposal may be submitted by only one of them. It should clearly describe the role to be played by the other organizations and indicate the legal and managerial arrangements contemplated. In other instances, simultaneous submission of related proposals from each organization might be appropriate, in which case parallel awards would be made.

(2) Where a project of a cooperative nature with NASA is contemplated, describe the contributions expected from any participating NASA investigator and agency facilities or equipment which may be required. The proposal must be confined only to that which the proposing organization can commit itself. "Joint" proposals which specify the internal arrangements NASA will actually make are not acceptable as a means of establishing an agency commitment.

**(g) Late Proposals.** Proposals or proposal modifications received after the latest date specified for receipt may be considered if a significant reduction in cost to the Government is probable or if there are significant technical advantages, as compared with proposals previously received.

**(h) Withdrawal.** Proposals may be withdrawn by the proposer at any time before award. Offerors are requested to notify NASA if the proposal is funded by another organization or of other changed circumstances which dictate termination of evaluation.

**(i) Evaluation Factors.**

(1) Unless otherwise specified in the NRA, the principal elements (of approximately equal weight) considered in evaluating a proposal are its relevance to NASA's objectives, intrinsic merit, and cost.

(2) Evaluation of a proposal's relevance to NASA's objectives includes the consideration of the potential contribution of the effort to NASA's mission.

(3) Evaluation of its intrinsic merit includes the consideration of the following factors of equal importance:

(i) Overall scientific or technical merit of the proposal or unique and innovative methods, approaches, or concepts demonstrated by the proposal.

(ii) Offeror's capabilities, related experience, facilities, techniques, or unique combinations of these which are integral factors for achieving the proposal objectives.

(iii) The qualifications, capabilities, and experience of the proposed principal investigator, team leader, or key personnel critical in achieving the proposal objectives.

(iv) Overall standing among similar proposals and/or evaluation against the state-of-the-art.

(4) Evaluation of the cost of a proposed effort may include the realism and reasonableness of the proposed cost and available funds.

**(j) Evaluation Techniques.** Selection decisions will be made following peer and/or scientific review of the proposals. Several evaluation techniques are regularly used within NASA. In all cases proposals are subject to scientific review by discipline specialists in the area of the proposal. Some proposals are reviewed entirely in-house, others are evaluated by a combination of in-house and selected external reviewers, while yet others are subject to the full external peer review technique (with due regard for conflict-of-interest and protection of proposal information), such as by mail or through assembled panels. The final decisions are made by a NASA selecting official. A proposal which is scientifically and programmatically meritorious, but not selected for award during its initial review, may be included in subsequent reviews unless the proposer requests otherwise.

**(k) Selection for Award.**

(1) When a proposal is not selected for award, the proposer will be notified. NASA will explain generally why the proposal was not selected. Proposers desiring additional information may contact the selecting official who will arrange a debriefing.

(2) When a proposal is selected for award, negotiation and award will be handled by the procurement office in the funding installation. The proposal is used as the basis for negotiation. The contracting officer may request certain business data and may forward a model award instrument and other information pertinent to negotiation.



**(l) Additional Guidelines Applicable to Foreign Proposals and Proposals Including Foreign Participation.**

(1) NASA welcomes proposals from outside the U.S. However, foreign entities are generally not eligible for funding from NASA. Therefore, unless otherwise noted, proposals from foreign entities should not include a cost plan unless the proposal involves collaboration with a U.S. institution, in which case a cost plan for only the participation of the U.S. entity must be included. Proposals from foreign entities and proposals from U.S. entities that include foreign participation must be endorsed by the respective government agency or funding/sponsoring institution in the country from which the foreign entity is proposing. Such endorsement should indicate that the proposal merits careful consideration by NASA, and if the proposal is selected, sufficient funds will be made available to undertake the activity as proposed.

(2) All foreign proposals must be typewritten in English and comply with all other submission requirements stated in the NRA. All foreign proposals will undergo the same evaluation and selection process as those originating in the U.S. All proposals must be received before the established closing date. Those received after the closing date will be treated in accordance paragraph (g) of this provision. Foreign sponsors may, in exceptional situations, forward a proposal without endorsement if the endorsement is not possible before the announced closing date. In such cases, the NASA sponsoring office should be advised when a decision on endorsement can be expected.

(3) Successful and unsuccessful foreign entities will be contacted directly by the NASA sponsoring office. Copies of these letters will be sent to the foreign sponsor. Should a foreign proposal or a U.S. proposal with foreign participation be selected, NASA's Office of External Relations will arrange with the foreign sponsor for the proposed participation on a no-exchange-of-funds basis, in which NASA and the foreign sponsor will each bear the cost of discharging their respective responsibilities.

(4) Depending on the nature and extent of the proposed cooperation, these arrangements may entail:

- (i) An exchange of letters between NASA and the foreign sponsor; or
- (ii) A formal Agency-to-Agency Memorandum of Understanding (MOU).

**(m) Export Control Guidelines Applicable to Foreign Proposals and Proposals Including Foreign Participation.**

(1) Foreign proposals and proposals including foreign participation must include a section discussing compliance with U.S. export laws and regulations, e.g., 22 CFR Parts 120-130 and 15 CFR Parts 730-774, as applicable to the circumstances surrounding the particular

foreign participation. The discussion must describe in detail the proposed foreign participation and is to include, but not be limited to, whether or not the foreign participation may require the prospective proposer to obtain the prior approval of the Department of State or the Department of Commerce via a technical assistance agreement or an export license, or whether a license exemption/exception may apply. If prior approvals via licenses are necessary, discuss whether the license has been applied for or if not, the projected timing of the application and any implications for the schedule. Information regarding U.S. export regulations is available at <http://www.pmdtc.org> and <http://www.bxa.doc.gov>. Proposers are advised that under U.S. law and regulations, spacecraft and their specifically designed, modified, or configured systems, components, and parts are generally considered "Defense Articles" on the United States Munitions List and subject to the provisions of the International Traffic in Arms Regulations (ITAR), 22 CFR Parts 120-130.

**(n) Cancellation of NRA.** NASA reserves the right to make no awards under this NRA and to cancel this NRA. NASA assumes no liability for canceling the NRA or for anyone's failure to receive actual notice of cancellation.

(End of provision)

## Appendix E

### Proposal Cover Sheet, Formats, Forms, and Required Declarations

#### Proposal Cover Sheet

NASA Research Announcement 00-OES-02

Proposal No. \_\_\_\_\_ (Leave Blank for NASA Use)

Title: \_\_\_\_\_

Principal Investigator:: \_\_\_\_\_

Department: \_\_\_\_\_

Institution: \_\_\_\_\_

Street/PO Box: \_\_\_\_\_

City: \_\_\_\_\_ State: \_\_\_\_\_ Zip: \_\_\_\_\_

Country: \_\_\_\_\_ E-mail: \_\_\_\_\_

Telephone: \_\_\_\_\_ Fax: \_\_\_\_\_

Co-Investigators:

Name	Institution & Email Address	Address & Telephone
_____	_____	_____
_____	_____	_____
_____	_____	_____

Budget:

1st Year: \_\_\_\_\_ 2nd Year: \_\_\_\_\_ 3rd Year: \_\_\_\_\_ Total: \_\_\_\_\_

#### Certification of Compliance with Applicable Executive Orders and U.S. Code

By submitting the proposal identified in this *Cover Sheet/Proposal Summary* in response to this Research Announcement, the Authorizing Official of the proposing institution (or the individual proposer if there is no proposing institution) as identified below:

- certifies that the statements made in this proposal are true and complete to the best of his/her knowledge;
- agrees to accept the obligations to comply with NASA award terms and conditions if an award is made as a result of this proposal; and
- confirms compliance with all provisions, rules, and stipulations set forth in the two Certifications contained in this NRA [namely, (i) *Certification of Compliance with the NASA Regulations Pursuant to Nondiscrimination in Federally Assisted Programs*, and (ii) *Certifications, Disclosures, And Assurances Regarding Lobbying and Debarment & Suspension*].

Willful provision of false information in this proposal and/or its supporting documents, or in reports required under an ensuing award, is a criminal offense (U.S. Code, Title 18, Section 1001).

Title of Authorizing Institutional Official: \_\_\_\_\_

Signature: \_\_\_\_\_ Date: \_\_\_\_\_

Name of Proposing Institution: \_\_\_\_\_

Telephone: \_\_\_\_\_ E-mail: \_\_\_\_\_ Facsimile: \_\_\_\_\_

## BUDGET SUMMARY

For period from \_\_\_\_\_ to \_\_\_\_\_

- Provide a complete Budget Summary for year one and separate estimated for each subsequent year.
- Enter the proposed estimated costs in Column A (Columns B & C for NASA use only).
- Provide as attachments detailed computations of all estimates in each cost category with narratives as required to fully explain each proposed cost. See *Instructions For Budget Summary* on following page for details.

		<u>  NASA USE ONLY  </u>	
	<b>A</b>	<b>B</b>	<b>C</b>
1. <u>Direct Labor</u> (salaries, wages, and fringe benefits)	_____	_____	_____
2. <u>Other Direct Costs</u> :			
a. Subcontracts	_____	_____	_____
b. Consultants	_____	_____	_____
c. Equipment	_____	_____	_____
d. Supplies	_____	_____	_____
e. Travel	_____	_____	_____
f. Other	_____	_____	_____
3. <u>Facilities and Administrative Costs</u>	_____	_____	_____
4. <u>Other Applicable Costs</u> :	_____	_____	_____
5. <u>SUBTOTAL--Estimated Costs</u>	_____	_____	_____
6. <u>Less Proposed Cost Sharing</u> (if any)	_____	_____	_____
7. <u>Carryover Funds</u> (if any)			
a. Anticipated amount : _____			
b. Amount used to reduce budget	_____	_____	_____
8. <u>Total Estimated Costs</u>	_____	_____	XXXXXXXX
9. APPROVED BUDGET	XXXXXXX	XXXXXXX	_____

## INSTRUCTIONS FOR BUDGET SUMMARY

1. Direct Labor (salaries, wages, and fringe benefits): Attachments should list the number and titles of personnel, amounts of time to be devoted to the grant, and rates of pay.
2. Other Direct Costs:
  - a. Subcontracts: Attachments should describe the work to be subcontracted, estimated amount, recipient (if known), and the reason for subcontracting.
  - b. Consultants: Identify consultants to be used, why they are necessary, the time they will spend on the project, and rates of pay (not to exceed the equivalent of the daily rate for Level IV of the Executive Schedule, exclusive of expenses and indirect costs).
  - c. Equipment: List separately. Explain the need for items costing more than \$5,000. Describe basis for estimated cost. General purpose equipment is not allowable as a direct cost unless specifically approved by the NASA Grant Officer. Any equipment purchase requested to be made as a direct charge under this award must include the equipment description, how it will be used in the conduct of the basic research proposed and why it cannot be purchased with indirect funds.
  - d. Supplies: Provide general categories of needed supplies, the method of acquisition, and the estimated cost.
  - e. Travel: Describe the purpose of the proposed travel in relation to the grant and provide the basis of estimate, including information on destination and number of travelers where known.
  - f. Other: Enter the total of direct costs not covered by 2a through 2e. Attach an itemized list explaining the need for each item and the basis for the estimate.
3. Facilities and Administrative (F&A) Costs: Identify F&A cost rate(s) and base(s) as approved by the cognizant Federal agency, including the effective period of the rate. Provide the name, address, and telephone number of the Federal agency official having cognizance. If unapproved rates are used, explain why, and include the computational basis for the indirect expense pool and corresponding allocation base for each rate.
4. Other Applicable Costs: Enter total explaining the need for each item.
5. Subtotal-Estimated Costs: Enter the sum of items 1 through 4.
6. Less Proposed Cost Sharing (if any): Enter any amount proposed. If cost sharing is based on specific cost items, identify each item and amount in an attachment.
7. Carryover Funds (if any): Enter the dollar amount of any funds expected to be available for carryover from the prior budget period. Identify how the funds will be

used if they are not used to reduce the budget. NASA officials will decide whether to use all or part of the anticipated carryover to reduce the budget (not applicable to 2nd-year and subsequent-year budgets submitted for award of a multiple year award).

8. Total Estimated Costs: Enter the total after subtracting items 6 and 7b from item 5.

## **Current And Pending Research Support From All Other Sources**

All proposals must include this information. This list should include all current and pending research support from the following sources:

1. Any proposal for which the PI of this proposal is also the Principal Investigator.
2. Any proposal, regardless of the PI, which accounts for more than 20% of the time of the Principal Investigator of this proposal and other personnel essential to this proposal.

Please provide this information in the following format:

### **I. Principal Investigator**

#### **A. Current Fiscal Year Support**

1. Source of Support and Principal Investigator
2. Award Amount and Period of Performance
3. Person-Months and Level of Effort
4. Project Title and Short Abstract (50 words or less)

#### **B. Pending Proposals (Excluding this proposal but including other proposals).**

1. Source of Support and Principal Investigator
2. Award Amount and Period of Performance
3. Person-Months and Level of Effort
4. Project Title and Short Abstract (50 words or less)

For both current and pending support provide information on:

### **II. Co-Investigators**

As outlined above, provide information on all Current and Pending Support. Disclosure of current and pending research support is not required for collaborators.

### **III. Other agencies to which this proposal, or parts thereof, has been submitted.**



**Certification of Compliance with the NASA Regulations Pursuant to  
Nondiscrimination in Federally Assisted Programs**

The *(Institution, corporation, firm, or other organization on whose behalf this assurance is signed, hereinafter called "Applicant ")* hereby agrees that it will comply with Title VI of the Civil Rights Act of 1964 (P.L. 88-352), Title IX of the Education Amendments of 1962 (20 U.S.C. 1680 et seq.), Section 504 of the Rehabilitation Act of 1973, as amended (29 U.S.C. 794), and the Age Discrimination Act of 1975 (42 U.S.C. 16101 et seq.), and all requirements imposed by or pursuant to the Regulation of the National Aeronautics and Space Administration (14 CFR Part 1250) (hereinafter called "NASA") issued pursuant to these laws, to the end that in accordance with these laws and regulations, no person in the United States shall, on the basis of race, color, national origin, sex, handicapped condition, or age be excluded from participation in, be denied the benefits of, or be otherwise subjected to discrimination under any program or activity for which the Applicant receives federal financial assistance from NASA; and hereby give assurance that it will immediately take any measure necessary to effectuate this agreement.

If any real property or structure thereon is provided or improved with the aid of federal financial assistance extended to the Applicant by NASA, this assurance shall obligate the Applicant, or in the case of any transfer of such property, any transferee, for the period during which the real property or structure is used for a purpose for which the federal financial assistance is extended or for another purpose involving the provision of similar services or benefits. If any personal property is so provided, this assurance shall obligate the Applicant for the period during which the federal financial assistance is extended to it by NASA.

this assurance is given in consideration of and for the purpose of obtaining any and all federal grants, loans, contracts, property, discounts, or other federal financial assistance extended after the date hereof to the Applicant by NASA, including installment payments after such date on account of applications for federal financial assistance which were approved before such date. The Applicant recognized and agrees that such federal financial assistance will be extended in reliance on the representations and agreements made in this assurance, and that the United States shall have the right to seek judicial enforcement of this assurance. This assurance is binding on the Applicant, its successors, transferees, and assignees, and the person or persons whose signatures appear below are authorized to sign on behalf of the Applicant.

## **CERTIFICATIONS, DISCLOSURES, AND ASSURANCES REGARDING LOBBYING AND DEBARMENT & SUSPENSION**

### **1. LOBBYING**

As required by Section 1352, Title 31 of the U.S. Code, and implemented at 14 CFR Part 1271, as defined at 14 CFR Subparts 1271.110 and 1260.117, with each submission that initiates agency consideration of such applicant for award of a Federal contract, grant, or cooperative agreement exceeding \$ 100,000, the applicant must **certify** that:

(1) No Federal appropriated funds have been paid or will be paid, by or on behalf of the undersigned to any person for influencing or attempting to influence an officer or employee of an agency, a Member of Congress, an officer or employee of Congress, or an employee of a Member of Congress in connection with the awarding of any Federal contract, the making of any Federal grant, the making of any Federal loan, the continuation, renewal, amendment, or modification of any Federal contract, grant, loan, or cooperative agreement.

(2) If any funds other than appropriated funds have been paid or will be paid to any person for influencing or attempting to influence an officer or employee of any agency, a Member of Congress, an officer or employee of Congress, or an employee of a Member of Congress in connection with the Federal contract, grant, loan, or cooperative agreement, the undersigned shall complete and submit a Standard Form-LLL, "Disclosure Form to Report Lobbying," in accordance with its instructions.

(3) The undersigned shall require that the language of this certification be included in the award documents for all subawards at all tiers (including subcontracts, subgrants, and contracts under grants, loans, and cooperative agreements) and that all subrecipients shall certify and disclose accordingly.

### **2. GOVERNMENTWIDE DEBARMENT AND SUSPENSION**

As required by Executive Order 12549, and implemented at 14 CFR 1260.510, for prospective participants in primary covered transactions, as defined at 14 CFR Subparts 1265.510 and 1260.117—

(1) The prospective primary participant **certifies** to the best of its knowledge and belief, that it and its principals:

(a) Are not presently debarred, suspended, proposed for debarment, declared ineligible, or voluntarily excluded by any Federal department or agency.

(b) Have not within a three-year period preceding this proposal been convicted of or had a civil judgment rendered against them for commission of fraud or a criminal offense in connection with obtaining, attempting to obtain, or performing a public (Federal, State or local) transaction or contract under a public transaction; violation of Federal or State antitrust statutes or commission of embezzlement, theft, forgery, bribery, falsification or destruction of records, making false statements, or receiving stolen property;

(c) Are not presently indicted for or otherwise criminally or civilly charged by a governmental entity (Federal, State or local) with commission of any of the offenses enumerated in paragraph (1)(b) of this certification; and

(d) Have not within a three-year period preceding this application/proposal had one or more public transactions (Federal, State or local) terminated for cause or default.

(2) Where the prospective primary participant is unable to certify to any of the statements in this certification, such prospective participant shall attach an explanation to this proposal.

**Appendix F**  
**List of Acronyms Used in this Research Announcement**

AUVSI	Association for Unmanned Vehicle Systems International
CIRPAS	Center for Interdisciplinary Remotely Piloted Aircraft Studies
ERAST	Environmental Research Aircraft and Sensor Technology
ESE	Earth Science Enterprise
FAR	Federal Acquisition Regulation
FY	Fiscal Year
GSFC	Goddard Space Flight Center
IAUS	International Association for Unmanned Systems
NASA	National Aeronautics and Space Administration
NFS	NASA FAR Supplement
NRA	NASA Research Announcement
OES	Office of Earth Science
OMB	Office of Management and Budget
PI	Principal Investigator
UAV	Uninhabited Aerial Vehicle
URL	Uniform Resource Locator
UAVSDP	UAV-Based Science Demonstration Program
WWW	World Wide Web